

Phases, Eclipses, and Tides

Guide for Reading

- What causes the phases of the moon?
- What are solar and lunar eclipses?
- What causes the tides?

As the moon moves, the positions of the moon, Earth, and the sun change in relation to each other. **The changing relative positions of the moon, Earth, and the sun cause the phases of the moon, eclipses, and tides.**

The moon orbits the Earth about once every 27.3 days. It also rotates on its own axis about once every 27.3 days. Because the moon's orbit and rotation take the same amount of time, the same side of the moon always faces Earth. The different shapes of the moon you see from Earth are called **phases**. **The phase of the moon you see depends on how much of the sunlit side of the moon faces Earth.** The moon completes one cycle of phases every 29.5 days.

When the moon's shadow falls on Earth or Earth's shadow falls on the moon, an eclipse occurs. An **eclipse** occurs when an object in space comes between the sun and a third object, and casts a shadow on that object. There are two types of eclipses: solar and lunar.

A solar eclipse occurs when the moon moves between Earth and the sun, blocking the sunlight from reaching Earth. The moon's shadow then hits Earth. So a **solar eclipse** occurs when a new moon blocks your view of the sun. The darkest part of the moon's shadow is called the **umbra**. From any part of the umbra, the moon completely blocks light from the sun. Only people in the umbra see a total solar eclipse. Another part of the shadow is less dark and larger than the umbra. It is called the **penumbra**. From within the penumbra, people see a partial eclipse because part of the sun is still visible.

A lunar eclipse occurs at a full moon when Earth is directly between the moon and the sun. During a lunar eclipse, Earth's shadow falls on the moon. Earth's shadow also has an umbra and a penumbra. When the moon is completely within Earth's umbra, you see a total lunar eclipse. A partial lunar eclipse happens when the moon moves partly into Earth's umbra.

Tides are the rise and fall of the ocean's water about every 12.5 hours. The force of gravity pulls the moon and Earth toward each other. **Tides are caused mainly by the moon's pull of gravity on different parts of the Earth.** As Earth rotates, the moon's gravity stretches water most on the side of the Earth facing the moon. The moon pulls less on the side of the earth facing away from the moon. Two high tides occur each day because of the Earth's rotation and the moon's pull of gravity.

Twice a month, the moon, Earth, and the sun are in a straight line. The combined forces of the gravity of the sun and moon produce high tides that are higher than usual—called a **spring tide**—and a low tide that is lower than usual. Also twice a month, the pull of gravity of the sun and moon are at right angles to each other. At those times the high tide is lower than usual, and is called a **neap tide**. The low tides then are higher than usual.

Earth, Moon, and Sun ▪ *Guided Reading and Study***Phases, Eclipses, and Tides**

This section explains what causes phases of the moon, what causes eclipses, and what causes the tides.

Use Target Reading Skills

Look at the Figure “Phases of the Moon” in your text. In the graphic organizer below, write a second question you have about the visuals. As you read about the moon, write the answers to both questions.

Q. Why does the moon have phases?
A.
Q. Why does the same side of the moon always face Earth?
A.

Motions of the Moon

1. Circle the letter of each sentence that is true about motions of the moon.

- a. The moon revolves around Earth once a year.
- b. The same side of the moon always faces Earth.
- c. The moon rotates slowly on its axis once every 27.3 days.
- d. A “day” and a “year” on the moon are the same length.

2. What causes the phases of the moon, eclipses, and tides?

Phases of the Moon


3. The different shapes of the moon you see from Earth are called _____.

4. How often does the moon go through an entire set of phases?

Phases, Eclipses, and Tides *(continued)*

5. What does the phase of the moon you see depend on?

6. Complete the table to show what you see during the different phases of the moon.

Phases of the Moon	
Phase	Describe what you see/draw a diagram
New moon	The side of the moon facing Earth is dark. 
First quarter	a.
Full moon	b.
Third quarter	c.

d. During which moon phases from the table can eclipses occur? Explain.

e. What percentage of the dark side of the moon do you see during the first and third quarters?

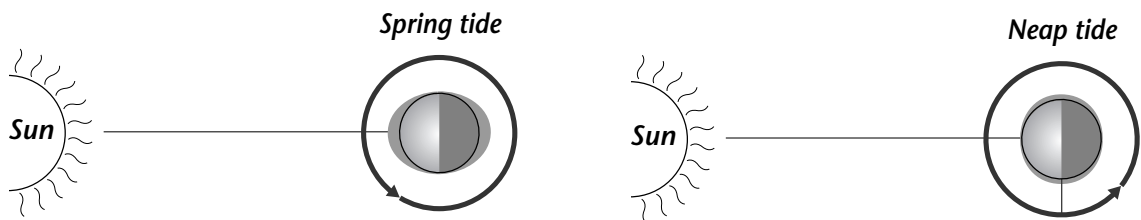
Eclipses

7. When the moon's shadow falls on Earth or Earth's shadow falls on the moon, what occurs?
- _____
8. What are the two types of eclipses?
- a. _____ b. _____
9. The darkest part of the moon's shadow is called the _____.
10. What causes a solar eclipse?
- _____
- _____
- _____
11. The larger part of a shadow, less dark than the umbra, is called the _____.
12. Circle the letter of each sentence that is true about solar eclipses.
- a. People in the umbra see only a partial solar eclipse.
 - b. During a partial solar eclipse, part of the sun remains visible.
 - c. During a total solar eclipse, the sky grows dark.
 - d. People in the penumbra see a total solar eclipse.
13. What is the arrangement of Earth, moon, and sun during a lunar eclipse?
- _____
- _____
14. Circle the letter of each sentence that is true about lunar eclipses.
- a. Anyone on Earth can see a total lunar eclipse.
 - b. A lunar eclipse always occurs at a full moon.
 - c. During a lunar eclipse, Earth blocks sunlight from reaching the moon.
 - d. A partial lunar eclipse occurs when the moon passes partly into the umbra of Earth's shadow.

Phases, Eclipses, and Tides *(continued)*

Tides

15. The rise and fall of ocean water is called _____ .
16. What force pulls the moon and Earth toward each other? _____
17. Why do tides occur?
- _____
- _____
- _____
18. Circle the letter of each sentence that is true about tides.
- a. The point on Earth that is closest to the moon has a high tide.
 - b. Every location on Earth has two high tides per month.
 - c. A low tide occurs at the point on Earth farthest from the moon.
 - d. The point on Earth farthest from the moon has a high tide.
19. What is a spring tide?
- _____
- _____
20. What is a neap tide?
- _____
- _____
21. On each of the diagrams below, draw a moon to show **both** its positions at spring tide and at neap tide.



22. Circle the letter of each of the phases of the moon when a spring tide occurs.
- a. new moon
 - b. first quarter
 - c. full moon
 - d. third quarter

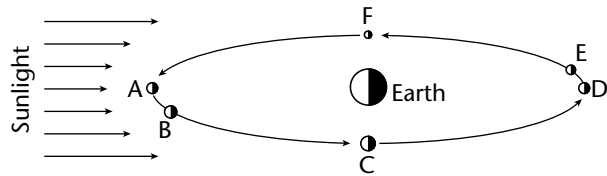
Phases, Eclipses, and Tides

Understanding Main Ideas

Use the figure below to answer questions 1 and 2.

1. What phases of the moon would someone on Earth see when the moon is at positions A through F?

A. _____ B. _____
 C. _____
 D. _____
 E. _____
 F. _____



2. What kind of tide (spring or neap) will occur when the moon is at positions A, C, D, and F?

A. _____ C. _____
 D. _____ F. _____

Building Vocabulary

From the list below, choose the term that best completes each sentence, and write it in the blank.

phase	gravity	penumbra	umbra	solar
tides	lunar	eclipse	spring	neap

- A(n) _____ tide occurs when the sun is at right angles to the line between Earth and the moon.
- A(n) _____ occurs when the moon's shadow hits Earth or Earth's shadow hits the moon.
- A person standing in the moon's _____ would see a partial solar eclipse.
- Differences in the moon's pull on different parts of Earth cause _____.
- A person standing in the moon's _____ would see a total solar eclipse.
- The _____ of the moon you see depends on how much of the sunlit side of the moon faces Earth.
- A(n) _____ tide occurs when the sun, moon, and Earth line up.
- A(n) _____ eclipse occurs at a full moon when Earth is directly between the moon and the sun.
- A(n) _____ eclipse occurs when the moon passes between Earth and the sun.
- The force of _____ pulls the moon and Earth toward each other.